

**Claims****What is claimed:**

1. A process for applying a catalyst ink onto a substrate, said process comprising:
  - (a) coating a substrate with a catalyst ink under conditions of controlled humidity and temperature to form a deposited catalyst ink on said substrate, wherein said catalyst ink comprises an electrocatalyst, an ionomer and water;
  - (b) leveling the deposited catalyst ink under conditions of controlled humidity and temperature to form a catalyst-coated substrate; and
  - (c) drying the catalyst-coated substrate at an elevated temperature.
- 10 2. The process according to claim 1, wherein said catalyst ink further comprises an organic solvent.
3. The process according to claim 2, wherein said catalyst ink further comprises a surfactant with a pressure between 1 and 600 Pascal.
- 15 4. The process according to claim 3, wherein the substrate is selected from the group consisting of a polymer film, an ionomer membrane, a carbon fiber, a carbon cloth, a carbon felt and a paper-type material.
5. The process according to claim 4, wherein said substrate is present in individual sheet or in continuous roll form.
- 20 6. The process according to claim 1, wherein the coating occurs in a coating compartment and the leveling occurs in a leveling compartment, and wherein the humidity in the coating compartment is maintained at 60 to 100 % relative humidity and a temperature in the range of 10 to 60°C, and the humidity in the leveling compartment is maintained at 60 to 100% relative humidity and at a temperature in the range of 10 to 60°C.
- 25 7. The process according to claim 6, wherein the leveling of the deposited catalyst ink is performed for a period of 1 to 10 minutes.

8. The process according to claim 7, wherein the drying of the catalyst ink is performed at a temperature in the range of 40 to 150°C for 1 to 10 minutes.
9. A device for the application of catalyst inks, said device comprising a coating machine, wherein said coating machine is comprised of:
  - 5 (a) a coating compartment for catalyst ink application; and
  - (b) a leveling compartment for leveling of the catalyst ink,and wherein said device is integrated into a continuous manufacturing line.
10. The device according to claim 9, wherein the coating compartment and the leveling compartment are a single compartment or separate compartments.
- 10 11. A composition comprised of a catalyst-coated membrane, wherein said catalyst-coated membrane is comprised of the catalyst-coated substrate produced according the process of claim 1.  
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- 15 12. A composition comprised of a catalyst-coated gas diffusion substrate, wherein said catalyst-coated gas diffusion substrate is comprised of the catalyst-coated substrate produced according to the process of claim 1.  
*Claim 13. A composition comprised of a catalyst-coated polymer film wherein said catalyst-coated polymer film is comprised of the catalyst-coated substrate produced according to the process of claim 1.*
- 20 14. A membrane-electrode-assembly comprising the catalyst-coated membrane of claim 10.  
*Claim 14. A membrane-electrode-assembly comprising the catalyst-coated gas diffusion substrate of claim 11.*
- 15 15. A membrane-electrode-assembly comprising the catalyst-coated polymer film of claim 12.  
*Claim 15. A membrane-electrode-assembly comprising the catalyst-coated polymer film of claim 12.*
- 25 16. A method of using the membrane-electrode-assembly of claim 14, comprising operating a PEMFC or DMFC fuel stack, wherein said fuel stack is comprised of said membrane-electrode assembly.  
*Claim 16. A method of using the membrane-electrode-assembly of claim 14, comprising operating a PEMFC or DMFC fuel stack, wherein said fuel stack is comprised of said membrane-electrode assembly.*

18 17. A method of using the membrane-electrode-assembly of claim 15, comprising  
operating a PEMFC or DMFC fuel stack, wherein said fuel stack is comprised  
of said membrane-electrode assembly

5 19 18. A method of using the membrane-electrode-assembly of claim 16, comprising  
operating a PEMFC or DMFC fuel stack, wherein said fuel stack is comprised  
of said membrane-electrode assembly